Dissociation During Intense Military Stress is Related to Subsequent Somatic Symptoms in Women

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ABSTRACT

Background: Research studies of the female response to intense stress are under-represented in the scientific literature; indeed, publications in female humans and animals number half those in male subjects. In addition, women have only recently entered more dangerous professions that were historically limited to men. The US Navy's survival course, therefore, offers a unique opportunity to examine, in a controlled manner, individual differences in the human female response to acute and realistic military stress.

Method: The current study assessed the nature and prevalence of dissociative symptoms and other aspects of adaptive function in healthy female subjects experiencing acute, intense stress during US Navy survival training. Cognitive dissociation and previous exposure to traumatic events were assessed at baseline in 32 female service members prior to Navy survival training. At the conclusion of training, retrospectively rated levels of dissociation during peak training stress and current health symptoms were assessed.

Results: Female subjects reported previous trauma (35%) and at least one symptom of dissociation at baseline prior to training (47%).

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Eighty-eight percent of subjects reported experiencing multiple symptoms of dissociation during peak training stress. Post-stress dissociation scores and stress-induced increases in dissociation, as well as prior cumulative exposure to potentially traumatic events, were significant predictors of post-stress health symptoms.

Discussion: In this study, increases in dissociative symptoms during intense training stress, post-stress dissociation symptom levels, and prior cumulative exposure to stressful, potentially traumatic events predicted post-stress health symptoms in women. Prior studies in men have demonstrated correlations between neurobiological responses to stress and stress-associated levels of dissociation. Thus future studies in larger samples of women are needed to investigate the relationship between prior stress exposure, alterations in neurobiological responses to stress and potentially related alterations in neuropsychological and physical reactions to stress.

INTRODUCTION

Although many people are exposed to trauma, only some individuals develop posttraumatic stress disorder (PTSD); most do not.[1–4] Further, a large portion of individuals who do develop the disorder fully remit over time. These data suggest that chronic PTSD may represent a specific type of response to trauma that is not typical of most individuals, but rather is seen in individuals who have a unique vulnerability to stress. To date, a number of specific psychosocial risk factors for PTSD have been identified, such as a history of exposure to traumatic events, exposure to multiple traumatic events, exposure to childhood sexual or physical trauma, and the subjective experience of fear for one's life.[5–7] However, these factors still leave a great deal of the variance unexplained, and investigations evaluating risk factors for the development of PTSD continue.

Over the past decade, numerous investigators have begun to re-examine the relationship between trauma, symptoms of dissociation, and the development of PTSD. Taken together, the data from numerous studies suggest that peritraumatic symptoms of dissociation (i.e., symptoms of dissociation experienced at and, for a short period of time, immediately after exposure to a traumatic event) represent a significant risk factor for the subsequent development of PTSD among both male and female subjects.[8–19] Peritraumatic dissociation also appears to be a risk factor for stress-related physical symptoms,[20,21] and recent studies have documented a relationship between somatic pain and PTSD symptoms in both military women and men.[22]

The following study was designed to examine the frequency and relationship between stress-related dissociative symptoms and somatic symptoms in generally healthy women engaged in a highly stressful military training exercise. This allowed us to examine the propensity to dissociate prior to and in response to stress exposure before the development of PTSD, as well as examine the association between the propensity for dissociation and stress-related physical symptoms.

While female subjects in the general population have a higher incidence of PTSD in response to traumatic stress than male subjects,[19,23,24] this sex difference in the incidence of PTSD risk is not well supported in military populations. It is possible that the different nature of war zone stressors experienced by male and female subjects,[25] as well as differences in proximity and access to medical care within theatre,[26] prevent valid direct comparison of outcomes. Nonetheless, it is also possible that operational roles assumed by female subjects in the military involve self-selection; female subjects who pursue them may be more stress-hardy. In the current study, for example, many of the women engaged in the US Navy's survival training have endured a selection process in the form of flight training and other highly challenging programs, from which women with less stress tolerance had already dropped out.

Survival, Evasion, Resistance, and Escape (SERE) school represents some of the most difficult and rigorous training in the US Navy. Developed for aviators and other military personnel at increased risk for evasion and captivity experiences, the Navy survival course is 12 days long and includes a low stress classroom phase and a highly stressful experiential phase. During the experiential phase, students first evade capture and then undergo confinement. Throughout, they are confronted with a variety of stressors, including intense physical exertion; semi-starvation; sleep deprivation; external control over movement, social contact, and communication; lack of control over personal hygiene; and mock training interrogations. These controlled and closely monitored stressful situations, in turn, provide participants the opportunity to apply their classroom training and receive constructive feedback.

Several factors make the SERE training course an ideal environment to study the relationship between highly intense stress and symptoms of dissociation. First, the course participants represent a healthy, nonclinical, sample of subjects who are at high risk for exposure to military-related trauma and, consequently, at risk for the development of combat-related stress disorders, such as PTSD. Second, the course allows for a highly controlled, closely monitored, and uniform application of stress across subjects. Third, the training scenario represents the best analog to realistic military stress as it is multidimensional (combines psychological, physical, and environmental stress), and results in neurobiological alterations that are

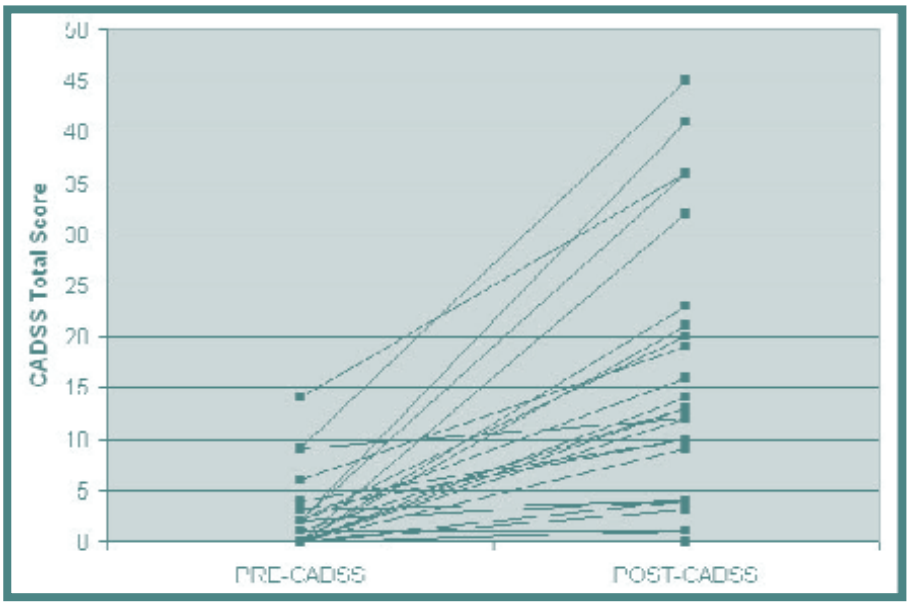

FIGURE 1. Within-subject change in CADSS total score

on a par with actual threat-to-life experiences.[27,28] Thus, SERE training provides an ethologically realistic setting for studying neuropsychobiological aspects of acute stress in humans (and in this case, females) and is well suited for a prospective examination of the relationship between acute stress and psychological symptoms of dissociation. Previous work in male soldiers at SERE school showed the majority experienced increases in self-reported dissociation following acute extreme stress.[29] On average, Special Forces soldiers, who are considered "stress-hardy," endorsed fewer pre- and post-stress dissociation symptoms in comparison to General Infantry soldiers. After acute stress exposure, dissociation symptoms also were associated with 41 percent of the variance in physical health problems.

METHODS

Subjects. Thirty-two of 42 consecutively recruited active duty female service members (age 23.2, SD=3; education 14.3, SD=2) were the subjects of this study. The average number of years in the service prior to enrollment at the survival school was five (SD=2.2). Fifty percent of the sample consisted of pilots (N=16). As per course requirements, all subjects received full medical and psychological clearance prior to in-processing to survival school; pertinent to the current study, diagnosis of any Axis I disorder precludes admission to SERE school. All subjects were free of illicit substances. After completion of in-processing, subjects were given a description of the nature and purpose of the study by the principal investigator. Each gave written, informed consent to participate in the study and understood that refusal to participate in the study would not adversely affect their standing in the survival course.

Rating instruments. Subjects were administered the Clinician Administered Dissociative States Scale (CADSS)[30] pre- and post-training. The CADSS is a 19-item self-report instrument designed to assess state symptoms of dissociation in response to a specified stressor and across repeated assessments. For each item, intensity of dissociative experience is rated on a scale of 0 (not present) to 4 (extreme) and each item is summed to produce the total score. This measure has demonstrated good internal consistency (Cronbach's alpha=0.94) and convergent validity. When filling out the pre-stress CADSS, subjects were instructed to use the last 24 hours of classroom activities as their reference point. When filling out the post-stress rating instruments, 24 hours after the termination of confinement stress, subjects were given instructions to complete the CADSS in response to the last 24 hours of confinement stress. Prior research employing a 24-hour delay prior to recall was positively correlated (r=0.62) with ratings obtained 15 minutes after stress exposure.[27]

Subjects also completed the Brief Trauma Questionnaire (BTQ) during the week of classroom (academic) activities prior to acute stress exposure. The BTQ is a valid, reliable, self-report instrument designed to assess ten types of potentially traumatic events to which an individual has been exposed.[31] The scale also asks subjects whether they suffered physical injury or threat to life in relation to each endorsed event. Endorsement of either of these items is interpreted as exposure to a DSM-IV criterion "A1" traumatic event. At the conclusion of the confinement phase, subjects also completed the Health Problems Checklist.[32] This instrument is a valid and reliable self-report instrument comprised of 80 items that assess current somatic symptoms (e.g., heart burn, chest pain, headache, ringing in ears, etc.). The total score is the number of items endorsed.

Data analysis. Reliability analyses were conducted on pre- and post-stress CADSS to assess item and scale reliability and consistency. Dissociation difference scores (pre-stress CADSS minus post-stress CADSS) were calculated as a measure of propensity to dissociate. Paired t-tests with Bonferroni corrections to control for inflation of Type I error assessed the change in CADSS total score and CADSS items following the exposure to severe stress. Multiple regression models examined predictors of post-stress dissociation, dissociation propensity, and post-stress health symptoms across all subjects. Pearson

correlations were used for univariate comparisons between pre- and post-CADSS scores, post-stress health symptoms, and dissociation propensity. BTQ items were summed to represent cumulative exposure to stressful live events (BTQ total score maximum=10). Responses on the BTQ were used to recode subjects into two groups: no trauma exposure (BTQ=0) and trauma exposure (BTQ≥1 and injury or threat to life endorsed) most similar to PTSD Criterion A1. Independent t-tests with Bonferroni corrections were used to compare groups (i.e., trauma/non-trauma and pilot/non-pilot subjects) on pre- and post-stress CADSS scores and post-stress health symptoms. Age and education were examined with chi-square tests and included in multivariate analyses as covariates when indicated by statistically significant differences in univariate tests. Statistical significance was set at p=0.05 for all analyses.

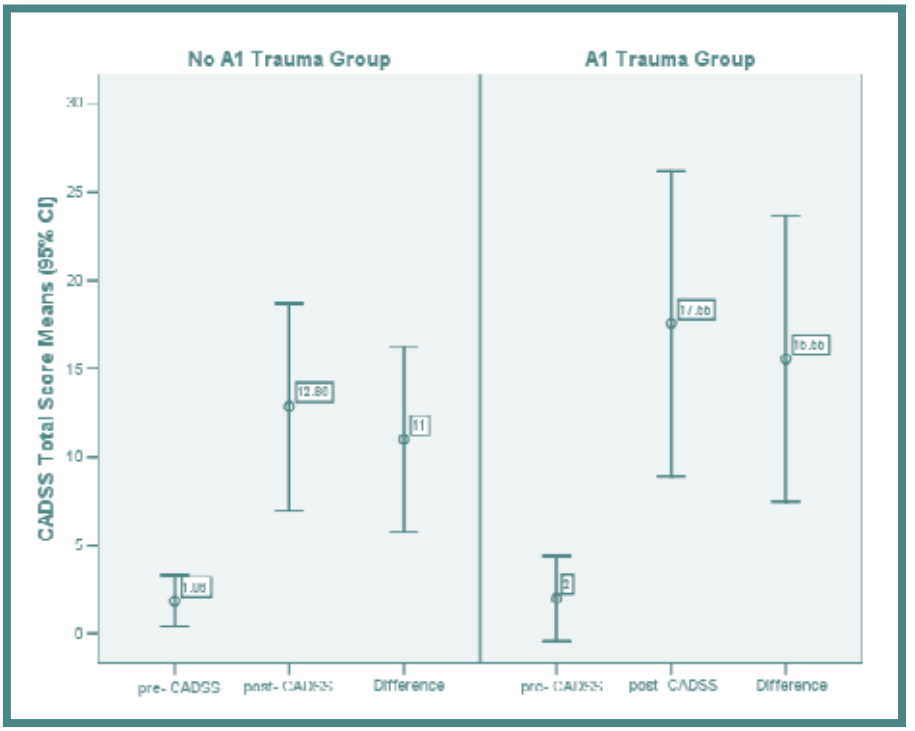

FIGURE 2. Average pre- and post-stress CADSS scores and pre- to post-stress differences in subjects with and without A1 trauma exposure.

RESULTS

Effects of survival school stress on dissociative symptoms. There was a substantial overall increase in reports of dissociative symptoms at post-stress exposure compared to baseline; on average, a 13-point increase from pre- to post-stress CADSS was observed. Internal consistency was good for pre- and post CADSS total scores: Chronbach's alpha was 0.78 for the pre-CADSS total score and 0.91 for the post-CADSS total score. Dissociation symptoms were endorsed in 47 percent of subjects during the classroom (pre-stress) phase, while 88 percent of subjects endorsed dissociation symptoms during the experiential confinement (post-stress) phase of SERE training. Twenty-eight of 32 subjects had an increase in dissociation symptoms across the two phases (Figure 1).

Paired t-test indicated significant within-subject differences between baseline and post-stress CADSS total scores (t=6.1; df=31; p<0.0001). Table 1 displays significant within-subject increases on all individual CADSS items with four exceptions (items 5, 7, 17, and 19). The most common symptoms of dissociation for the group at post-stress were "spacing out" (item #15, 69%), "things moving in slow motion" (item #1, 59%), "things seemed unreal/dreamlike" (item #2, 53%), "things happen that cannot be accounted for later" (item #14, 53%), and "sounds disappear or become stronger than expected" (item #16, 50%). Baseline and post-stress CADSS total scores were moderately correlated (r=0.44; p<0.02).

Prediction of dissociation scores. Subjects reported experiencing an average of 1.8 potentially traumatic life events on the BTQ prior to SERE training (SD=2.2, range: 0–8). Almost 35 percent of subjects (N=11) reported previous exposure to at least one A1-trauma (a potentially traumatic event along with physical or life endangerment). Previous exposure to potentially traumatic stressful life events (BTQ total event scores) and A1 trauma did not differ between pilot and non-pilot subjects.

Subjects classified with A1 trauma exposure had greater mean pre- and post-stress CADSS scores and CADSS difference scores, although independent t-tests were not significant (p=0.91, 0.33, and 0.31, respectively) (Figure 2). In addition, BTQ Total event scores were not significantly correlated with pre- or post-stress CADSS scores, or with CADSS difference scores (p=0.33, 0.10, and 0.13, respectively).

Pre- and post-stress CADSS scores, as well as CADSS difference scores also did not differ significantly between pilots compared to the non-pilot subjects (ps=0.37, 0.38, and 0.22, respectively), although pilot means were consistently lower than non-pilot means. BTQ Total event scores also were not different between the pilot and non-pilot groups (p=0.38).

Repeated measures ANOVA confirmed that CADSS scores increased between baseline and post-stress time points [F(1,28) = 38.9, p<0.0001], and that there were no between-subject main effects or interactions for the A1 trauma or pilot groups.

TABLE 1. Within-subject increases in CADSS scores from pre- to post-stress exposure

CADSS Item		*T* values[a]
1.	Things moving in slow motion	4.45*
2.	Things seem to be unreal/dreamlike	4.93*
3.	Feeling separate from what is happening as if in a movie	3.82*
4.	Feel as if looking at things from outside of body	3.46*
5.	Feel as if watching situation as an observer or spectator	1.18
6.	Feel disconnected from body	3.14[t]
7.	Sense of body feels changed (e.g., unusually small or large)	2.49
8.	People seem motionless, dead, or mechanical	3.00[t]
9.	Objects look different than expected	3.13[t]
10.	Colors seem to be diminished in intensity	4.00*
11.	See things as if in a tunnel or looking through a wide-angle photographic lens	3.86*
12.	Experience seems to take much longer than expected	4.10*
13.	Things seem happen very quickly as if there is a lifetime in a moment	3.21[t]
14.	Things happen that cannot be accounted for later	5.36*
15.	"Space out," or in some other way lose track of what is going on	4.45*
16.	Sounds almost disappear or become much stronger than expected	4.84*
17.	Things seem to be very real, as if there is a special sense of clarity	1.97
18.	Looking at world through a fog; people and objects appear far away or unclear	3.47[t]
19.	Colors seem much brighter than expected	2.10

[a] *df*=31
* With Bonferroni corrections: significant at $p<0.0026$
[t] Trend for significance at $p<0.0053$

Prediction of physical health symptoms. Post-stress physical health symptoms were correlated with cumulative exposure to potentially traumatic events (BTQ Total) ($r=0.50$, $p<0.01$), but were not associated with previous A1 trauma exposure ($p=0.38$). Health-related symptoms were also significantly correlated with pre- and post-stress CADSS scores, as well as CADSS difference scores ($r=0.58$, $p<0.01$, $r=0.76$, $p<0.0001$, and $r=0.63$, $p<0.005$, respectively) (Figure 3). Physical health symptoms did not differ between the pilot and non-pilot groups.

A multiple regression used to predict post-stress health symptoms from A1 Trauma exposure and post-stress CADSS scores was significant [$F(2, 31)=18.06$, $p<0.0001$] and accounted for 56 percent of the variance in health symptoms. A positive linear trend was observed for post-stress CADSS scores ($t=7.65$, $p<0.0001$) but not for A1 Trauma group. A similar regression model using CADSS difference scores produced comparable results: The overall model accounted for 57 percent of the variance [$F(2,31)=19.32$, $p<0.0001$] and there was a significant linear trend for CADSS difference scores ($t=5.75$, $p<0.0001$). The addition of Pilot group as a predictor did not account for additional explained variance in either model.

A multiple regression model including BTQ Total and post-stress CADSS scores explained 75 percent of the variance in post-stress health symptoms [$F(2,31)=43.79$, $p<0.0001$]. There were significant linear effects for both BTQ Total ($t=2.90$, $p<0.01$) and post-stress CADSS scores ($t=7.65$, $p<0.0001$). The substitution of CADSS difference scores for post-stress CADSS scores led to similar results: Sixty-five percent of the variance in post-stress health symptoms was explained by the model [$F(2,31)=26.34$, $p<0.0001$]. There were significant linear effects for both BTQ Total ($t=2.79$, $p<0.01$) and CADSS difference scores ($t=5.69$,

$p<0.0001$). The addition of Pilot group as a predictor did not account for additional explained variance in either of these models.

DISCUSSION

Brief summary of findings. This is the first study to examine dissociative and somatic symptoms among female military members in a setting shown to induce levels of stress comparable to combat exposure. The study demonstrates a significant increase in symptoms of dissociation in response to intense military training stress in women, as well as a strong correlation between dissociative symptoms experienced during intense stress and post-stress physical health symptoms.

Gender comparisons in responses to extreme stress. This project takes a small step toward a better understanding of the similarities and differences in the stress response between men and women. The data provides support for the notion that symptoms of dissociation are exceedingly ordinary, and similarly common, for healthy female and male subjects experiencing acute, highly intense stress.[29] Eighty-eight percent of women in the current study and 96 percent of men in the previous study reported symptoms of dissociation during intense stress. Further, approximately 47 percent of women in this study and 42 percent of men in the previous study endorsed baseline symptoms of dissociation, prior to SERE training. In both women and men, there were significant correlations between pre- and post-stress dissociation scores (r=0.44 and 0.45, respectively).

Women and men also similarly endorsed peritraumatic dissociation items: Women most frequently endorsed "you spaced out or lost track of what was going on" after stress, which was second among men (both 69%). However, women were less likely to report "things seem to take much longer than expected" (43% vs. 92% in men) and "things seem very real, as if there were a special sense of clarity" (47% vs. 66% in men).

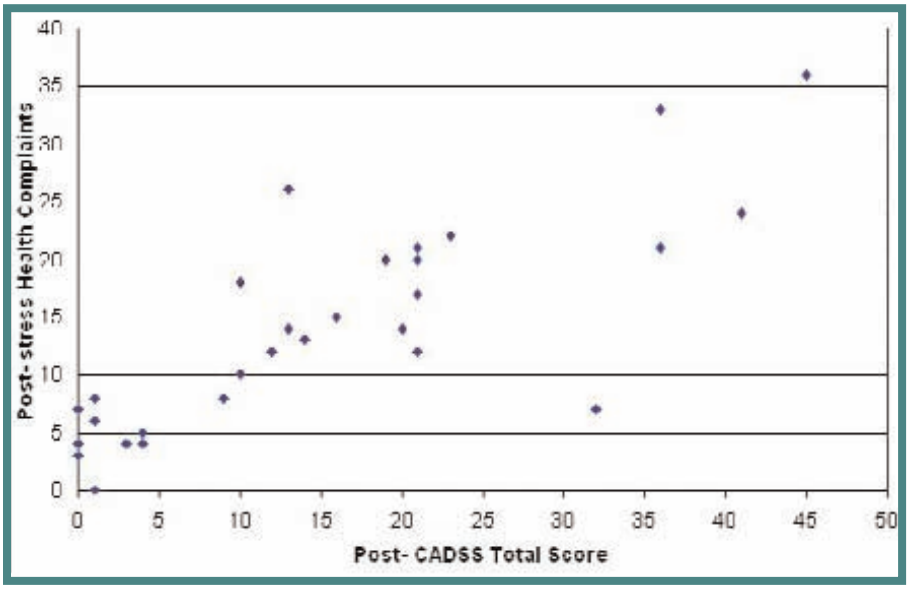

FIGURE 3. Correlations between post-stress CADSS scores and somatic symptoms

Pre-stress dissociation scores were most similar among women and Special Forces soldiers (1.9 and 1.6 mean pre-CADSS, respectively) and lower for women in comparison to general infantry soldiers (6.0). Average post-stress dissociation scores in women (14.5) fell between Special Forces (9.7) and general infantry (21.3) soldiers. These data thus suggest that the women in the current study represent a self-selected, stress hardy group.

Notably, women demonstrated a much stronger relationship between stress-induced symptoms of dissociation and post-stress health symptoms (r=0.76, $p<0.0001$) in comparison to men (r=0.54, $p<0.02$),[29] yet did not differ on the strength of the correlation between change in dissociation scores and health symptoms (r=0.63, $p<0.005$, r=0.67, $p<0.01$). Whether this finding reflects a difference in pathophysiology or is a result of the homogeneity of this select sample of participant remains to be elucidated in future studies.

The relationship between stress-induced dissociative and somatic symptoms. The finding of a strong relationship between dissociation symptoms during stress and post-stress physical symptoms in women in the current study is consistent with a recent study of 600 adults in Gaza, in which peritraumatic dissociation, while controlling for lifetime trauma exposure, accounted for approximately 25 percent of the variance in somatic symptoms in women and men.[33] The basis for such a relationship between symptoms of dissociation and physical health symptoms is not yet well understood. However, previous investigations in men at military survival school have provided robust evidence that neuroendocrine responses to extreme stress (e.g., peak stress plasma neuropeptide Y [NPY] levels or dehydroepiandrosterone sulfate [DHEAS] to cortisol ratios) predict stress-associated dissociative symptoms.[34] It is, therefore, possible that such neurobiological factors contribute to the development of physical health symptoms after stress. Such a neurobiological predisposition to dissociation and stress-related physical problems may also account for the previous finding of an association between PTSD symptoms and somatic symptoms (e.g. pain) in military women and men.[22]

Alternatively, it is possible that women or men predisposed to dissociation express psychological

distress somatically. This seems to be a less likely explanation since studies of men at SERE school showed a relationship between dissociative symptoms and health symptoms, as well as an association between dissociative symptoms and level of psychological distress.[29] In other words, these subjects did not appear to substitute physical health symptoms for expressions of psychological distress.

Unlike previous findings in larger studies of men at US Navy survival school, the small sample of women with prior PTSD Criterion A1 traumatic exposure in the current study did not report greater levels of dissociation during exposure to stress. The current study did show, however, that previous cumulative exposure to potentially traumatic stressful events was independently associated with increased physical health symptoms after stress. This suggests that in women predisposed to dissociative symptomatology, the risk for negative physical health outcomes may increase with cumulative stress whether the stress is perceived as traumatic or not. Since peritraumatic dissociation is also a risk factor for PTSD, such individuals thus may be at risk for disabling physical, as well as psychiatric, consequences of military trauma exposure. If true, gaining an understanding of the neuropsychobiological factors that predispose to dissociative symptomatology should become a priority, both to protect the wellbeing of such predisposed individuals as well as to mitigate the demands on our already overburdened health systems.

Study limitations. The findings of the current study must be interpreted in the context of a number of study limitations. Importantly, the study was underpowered to detect significant differences in dissociative symptoms relating to previous trauma exposure and pilot/non-pilot or other potentially relevant group memberships; of note, previous studies detecting such relationships in men were conducted in approximately 100 subjects. The BTQ may also under-detect A1 trauma by failing to query exposure to potentially traumatic events in which others, but not the respondent, were exposed to physical injury or life threat. The current study also did not characterize menstrual cycle status or use of oral contraception among the participants, factors that could potentially affect neurobiological responses, dissociative symptoms, and physical symptoms during and after extreme stress.[34] In addition, it would have been enlightening to examine the relationship between dissociative symptomatology, psychological distress, and military performance as previously done in male SERE school participants.

CONCLUSION

This study demonstrates that women as well as men commonly experience an increase in dissociative sensory disturbances during exposure to extreme military stress. The presence of such dissociative symptoms appears to be weakly associated with previous, potentially traumatic stress exposure. In both men and women, however, stress-related dissociative symptoms strongly predict post-stress physical symptoms.

Future larger studies thus are needed to better examine: A) the relationship between stress-induced dissociative symptoms and previous stress exposure; B) sex-specific neuropsychobiological vulnerabilities that may mediate both dissociative and physical health reactions to extreme stress;[34] C) the relationship between dissociative symptoms and military performance as well as psychological distress in women; and D) the possible role of these factors in the development of enduring health problems and psychiatric disorders, such as PTSD, that too commonly result from extreme military stress.

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